CHAPTER I — OPERATIONAL PROCEDURES

1. GENERAL

Services provided by the Joint Typhoon Warning Center (JTWC) include forecasts of tropical cyclone formation, location, intensity, direction and speed of movement, and horizontal extent of critical wind speeds (30 knots or greater). This information was disseminated in 1974 by: (1) Tropical Cyclone Formation Alerts issued whenever interpretation of satellite and synoptic data indicated formation of a tropical cyclone was likely; (2) Tropical Cyclone Warnings issued four times daily whenever a significant tropical cyclone was present in the western North Pacific; (3) Tropical Cyclone Warnings issued twice daily whenever a significant tropical cyclone was present in the Bay of Bengal; and (4) Tropical Weather Summaries issued daily with a detailed description of all significant tropical disturbances.

FLEWEACEN Guam provides computerized meteorological/oceanographic products for JTWC. Communication support is furnished by the Naval Telecommunications Center (NTCC) of the Naval Communications Station, Guam.

2. ANALYSES AND DATA SOURCES

a. COMPUTER PRODUCTS:

Use of the varian plotter by the FLEWEACEN Guam Computer Center during 1974 eliminated some of the JTWC hand plotting effort. Varian charts are produced routinely at synoptic times for the surface, 850 mb, 700 mb, and 500 mb levels. In addition, a chart of upper tropospheric data is produced which uses 200 mb rawinsonde data and AIREPS above 33,000 feet within six hours of the 0000Z and 1200Z synoptic times. Data not in the proper format for the computer are hand plotted on the charts. These include pibal gradient-level winds, satellite-derived winds, and missing or late synoptic reports necessary for a detailed analysis.

In addition, the standard array of synoptic-scale computer analyses and prognostic charts from the Fleet Numerical Weather Central (FNWC) at Monterey, California are available.

JTWC extensively utilized the FLEWEACEN Guam Computer Center for objective forecast techniques and statistical post-analysis.

b. JTWC ANALYSES:

(1) Gradient-level (3000 feet) streamline analysis (south of 20°N) and isobaric analysis (north of 20°N) at 0000Z and 1200Z.

(2) 500 mb contour analysis at 0000Z and 1200Z.

(3) A composite upper tropospheric streamline analysis utilizing rawinsonde data from 300 mb to 150 mb and AIREPS at or above 29,000 feet at 0000Z and 1200Z

(4) Reports from weather reconnaissance aircraft are plotted on large-scale sectional charts.

(5) Additional sectional analyses similar to those above, at intermediate synoptic times, during periods of tropical cyclone activity.

c. SATELLITE DATA:

DMSP satellite data played a major role in the early detection of tropical cyclones in 1974. This aspect, as well as applications of satellite data to tropical cyclone tracking, is discussed in Chapter II.

d. RADAR:

Land radar reports, when available, were used for tracking tropical cyclones during the 1974 season. Once a storm moved within range of a land radar site, reports were usually received hourly. Use of radar during 1974 is discussed in Chapter II.

3. FORECAST AIDS

a. CLIMATOLOGY:

Various climatological publications listed in earlier Annual Typhoon Reports were utilized in addition to the following recently received publications:

(1) Changes in the Characteristics of Typhoons Crossing the Island of Taiwan (Brand, S. and J. W. Blelloch, 1973).

(2) Handbook for Forecasters in the Bay of Bengal (Cuming, M. J., 1973).

(3) A Tropical Cyclone Analog Program for the North Indian Ocean (Brand, S., J. M. Long, J. W. Blelloch, and G. D. Hamilton, 1974).

(4) Annual Typhoon Reports, 1959-1973 (FWC/JTWC).

b. OBJECTIVE TECHNIQUES:

During 1974, the following objective forecasting techniques were employed (an evaluation of the techniques is presented in Chapter V):

(1) EXTRAPOLATION - Storm movement is extrapolated by using the past 12-hour mean speed and direction for both 24- and 48-hour forecasts. Forecasts are determined by simple linear extrapolation using the 12-hour old best track position and the current warning position.

(2) MOHATT (modified HATRACK) - Steering by geostrophic winds derived from smoothed height fields at 700 mb and 500 mb levels, biased by 12-hour history inputs.

(3) TYMOD - Steering by global band upper air fields (GBUA) from FNWC Monterey, biased by 12-or 24-hour history inputs.

(4) TYFOON- Analog weighted mean track.

(5) FCSTINT - Uses statistical regression equations to make 24-, 48-, and 72-hour intensity forecasts.

4. FORECASTING PROCEDURES

a. TRACK FORECASTING:

An initial forecast track is developed based on persistence, climatology, and objective techniques. This initial track is subjectively modified based on the following:

(1) The objective techniques are evaluated in conjunction with the best steering level.

(2) The prospects for recurvature are evaluated for all westward moving storms. The basic requisites for this evaluation are accurate continuity on mid-latitude troughs and numerical progs to indicate changes in amplitude or movement of troughs and the subtropical ridge. The northward tendency due to internal forces of each storm is also an important consideration.

(3) Steering is further evaluated by considering the latest upper air analyses as representative of the average upper air flow for the past 24-hours. These analyses are roughly 12 hours old thereby approximating the mid-point of the past 24-hour time interval. By this technique actual past 24-hour movement serves to indicate the best steering level as well as the effectiveness of steering.

(4) A final check is made against climatology to ascertain the likelihood of the forecast track. If the forecast is climatologically unusual, the forecast rationale is reappraised and the forecast track adjusted as necessary.

b. For intensity forecasting, heavy reliance is placed on aircraft reconnaissance reports, the Dvorak satellite interpretation model, and the TYFOON and FCSTINT objective techniques. Upper tropospheric outflow, sea surface temperatures, terrain influences, and speed of movement are additional considerations.

5. WARNINGS

Tropical cyclone warnings are numbered sequentially. If warnings are discontinued and the storm reintensifies, as Typhoon Mary did this year, warnings are numbered consecutively from the last warning issued. Amended or corrected warnings are given the same number as the warnings they modify plus a sequential alphabetical designator to indicate that it is an amended warning. In 1974, a variable warning time was employed to maximize the use of all available reconnaissance platforms and permit flexibility in spreading the warning workload during multiple storm situations. Warnings within the JTWC primary area of responsibility are issued within two hours of 0000Z, 0600Z, 1200Z, and 1800Z with the constraint that two consecutive warnings may not be more than seven hours apart. The forecast intervals are 12 and 24 hours for tropical depressions and 12, 24, 48, and 72 hours for typhoons and tropical storms. Warnings in the JTWC secondary area of responsibility are issued within two hours of 0800Z and 2000Z with the constraint that two consecutive warnings may not be more than 14 hours apart. Warnings for the secondary area are issued only after a tropical cyclone has reached an intensity of 34 knots or greater. The forecast intervals are 24 and 48 hours.

The variable warning time was utilized for 227 warnings out of a possible 657 or for 34.6% of the warnings. Only 29 of these 227 warnings were ± 2 hours from the normal warning times of 0000Z plus every 6 hours. The remainder of the variable warnings were within ± 1 hour of the normal warning times. Of the 173 levied satellite fixes during 1974, 81 were made possible by use of the variable warning time. If the variable warning time had not been available, these 81 fixes would have been levied on aircraft or land radar (if available) and the levy rate for satellite would have been 17.3% instead of the actual 32.5%.

Forecast periods are stated with respect to warning time. Thus, a 24-hour forecast normally verifies 26-28 hours after the latest aircraft or satellite fix and 30-36 hours after the latest surface synoptic chart and upper air charts.

Warning forecast positions are verified against the corresponding post analysis "best track" positions. A summary of verification results for 1974 is presented in Chapter V.

6. PROGNOSTIC REASONING MESSAGE

Whenever warnings for typhoons and tropical storms are issued, a prognostic reasoning message is transmitted at 0000Z and 1200Z for the JTWC primary area of responsibility. This message is intended to provide field meteorologists with the reasoning behind the latest JTWC forecasts.

7. TROPICAL WEATHER SUMMARY

This message, summarizing atmospheric conditions in the JTWC area of responsibility, is issued at 0600Z daily from 1 June to 30 November, and otherwise when the threat of tropical cyclone development exists or when warnings are being issued. It contains a detailed description of all significant tropical disturbances and JTWC's evaluation of potential for development.

8. TROPICAL CYCLONE FORMATION ALERT

Alerts are issued whenever interpretation of synoptic and other meteorological data suggests that formation of a significant tropical cyclone is likely. These alerts are valid for up to 24 hours unless cancelled or reissued.